

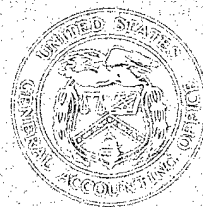


Report to the Chairman, Subcommittee  
on Military Research and Development,  
Committee on National Security, House  
of Representatives

October 1997

# BRILLIANT ANTIARMOR SUBMUNITION

## Opportunity Exists to Conduct Critical Test Prior to Production Decision



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United States  
General Accounting Office  
Washington, D.C. 20548

National Security and  
International Affairs Division

B-276833

October 30, 1997

The Honorable Curt Weldon  
Chairman, Subcommittee on Military  
Research and Development  
Committee on National Security  
House of Representatives

Dear Mr. Chairman:

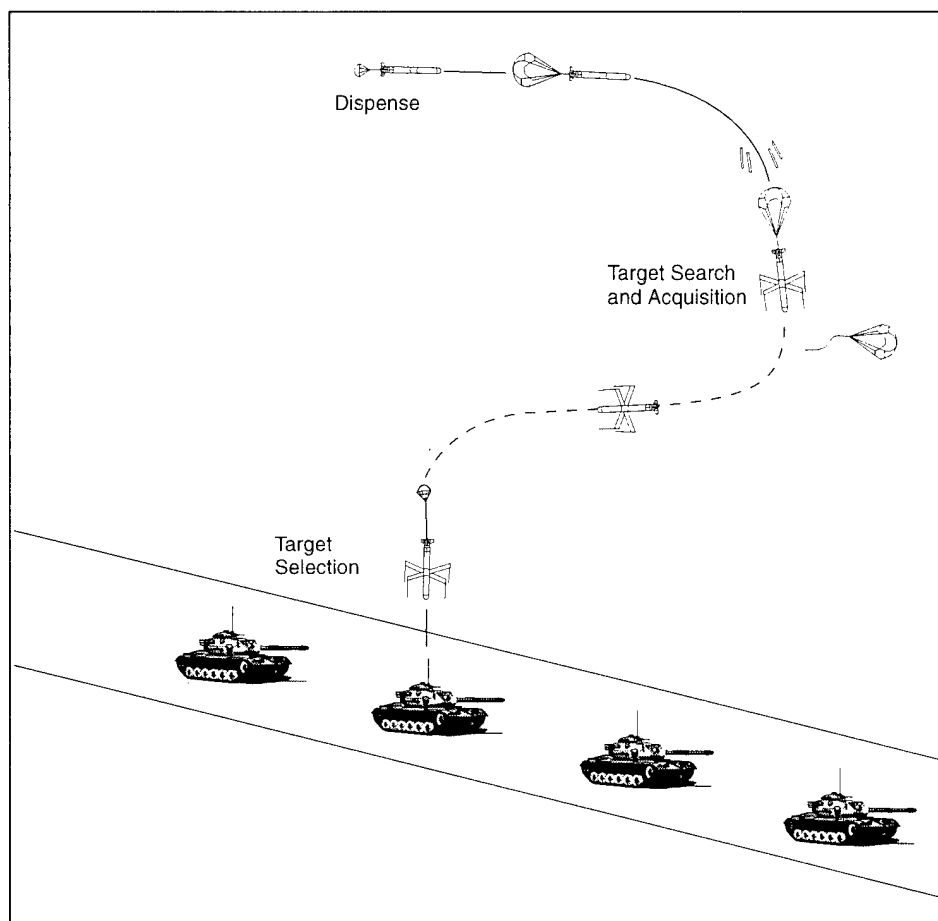
The Army has been developing the brilliant antiarmor submunition (also referred to as BAT) since 1984 and plans to request authority to start low-rate initial production in December 1997. At your request, we are providing our assessment of the status of its acquisition plans and whether it is technically ready to enter production.

## Background

The Army is developing the brilliant antiarmor submunition, with acoustic and infrared seekers working in tandem, to autonomously search for, track, and destroy moving armored targets. This submunition is to be carried deep into enemy territory by the Army Tactical Missile System (ATACMS) Block II missile, which is still in development and is a modification of the in-production ATACMS Block IA missile, which carries a different submunition. The brilliant antiarmor submunition and the ATACMS Block II missile are a \$4-billion system designed to support the Army's "deep fires" mission, which calls for the destruction and/or disruption of enemy forces at ranges exceeding 100 kilometers. Each Block II missile is to carry 13 submunitions that will be dispensed over large clusters of high payoff targets to attack and destroy individual targets. The advantage of the submunition is that it can cover a large area when dispersed, which allows it to compensate for target location errors. Figure 1 shows the submunition acquiring a moving column of tanks.

DTIC QUALITY INSPECTED 8

**Figure 1: The Brilliant Antiarmor Submunition Acquiring a Moving Target**



The brilliant antiarmor submunition program was established in 1984 as a special access program and progressed to a successful engineering and manufacturing development phase decision in May 1991. The Tri-Service Standoff Attack Missile was designated as the first delivery vehicle for the submunition, but when the Army terminated its participation in the program in December 1993, the ATACMS Block II missile was designated as the submunition's carrier. This change of carrier and continued technical difficulties have led to significant cost growth. The current program office estimate shows that development costs have increased from \$700 million to \$1.2 billion (in constant 1991 dollars) from the initial February 1992

estimate.<sup>1</sup> Projected production costs have also risen by almost \$7,000 per submunition (in constant 1991 dollars). The Army currently plans to produce 2,352 submunitions during low-rate initial production and a program total of 19,871 during fiscal years 1998-2006. According to current Army documentation, the average procurement cost of a single Block II missile loaded with 13 brilliant antiarmor submunitions is about \$2.3 million (in constant 1991 dollars).

## Results in Brief

A decision on low-rate initial production of the brilliant antiarmor submunition, scheduled for December 1997, appears to be premature because a crucial technical demonstration will not be accomplished by that time. In 1995, the Office of the Secretary of Defense (OSD) and the Army agreed to relax the performance criteria that the brilliant antiarmor submunition was to meet before proceeding into low-rate initial production. Under the new criteria, the Army is not required to demonstrate that the submunition can be successfully dispensed from the ATACMS Block II missile. In September 1994, the Department of Defense (DOD) noted, in its comments to our draft classified report, that the successful completion of multiple tests of the submunition with the ATACMS as the carrier would be required. Without such a test, the Army would have little or no assurance that the submunition to be acquired under low-rate initial production could successfully meet performance and technical requirements.

The submunition's current test schedule also appears to be extremely ambitious. Its development program is almost 3 years behind its original schedule, and a significant portion of the test schedule remains uncompleted. The project office added five development flight tests to the schedule because of technical problems. In addition, the Army plans to use a test aircraft for all submunition flight testing with subsonic deployment rather than the supersonic deployment from the ATACMS Block II missile. The testing completed to date has uncovered numerous problems that required design changes, additional testing, and schedule delays. Army program officials admit that the testing schedule is extremely ambitious, but they assume it will be successful.

Although the submunition test plans do not include an evaluation of whether or not the ATACMS Block II can dispense the submunition, the

<sup>1</sup>According to program office data, \$270 million of the \$500 million in development cost increase is associated with developing an improved submunition. The new brilliant antiarmor submunition is scheduled to be introduced into the production line in fiscal year 2001. It is designed to increase lethality and add the capability to attack cold, stationary, armored targets.

Block II missile test plans do include a test to dispense tactical submunitions in December 1997, the same month that the decision is to be made on low-rate production of the submunition. However, according to Army representatives, data from this test will not be used in making the submunition production decision, since the test is not required. In addition, any delays in qualifying the submunition's subcomponents and developmental flight testing will likely postpone the date of the Block II dispense test. The Army's ability to complete the remaining portion of the submunition's test schedule on time is highly suspect, considering the repeated number of testing failures already experienced. Therefore, it is probable that the ATACMS Block II dispense test will be delayed.

The submunition's schedule is unnecessarily ambitious. According to program officials, the driving factor for making the production decision in December 1997 is for the submunition's delivery schedule to coincide with the Block II missile's delivery schedule. However, a review of the program office's production lead time and delivery requirements shows that the submunition's low-rate initial production contract can be awarded 8 months later than currently scheduled and the submunition can still be delivered in time to be integrated into the missile. This would allow the Army additional time to complete the submunition's development testing and the ATACMS dispense test before awarding the contract.

The ATACMS Block IA's planned full-rate production decision was recently delayed by 1 year, to March 1998, because of target acquisition problems. According to representatives from the Office of the Director, Operational Test and Evaluation, the Block IA missile's problems will also affect the Block II missile. Therefore, the Block II missile's currently scheduled production date is uncertain. If its production date is delayed, the Army would have even more time to sufficiently complete key submunition developmental testing.

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## Key Performance Criteria Relaxed

One of the brilliant antiarmor submunition's original criteria for starting low-rate initial production was to demonstrate that it could be successfully dispensed from its carrier. This criterion was established in an acquisition decision memorandum dated May 1991 for the submunition and its original missile carrier, the Tri-Service Standoff Attack Missile. With the termination of the Army's participation in this missile program and the selection of the ATACMS as the new carrier in 1993, new criteria were subsequently developed.

In a 1994 classified report on the brilliant antiarmor submunition, we raised the issue of the lack of sufficient testing requirements in the criteria. We recommended that the Secretary of Defense direct the Secretary of the Army to conduct substantial system-level testing before low-rate initial production was approved. DOD's written response to that report stated that the decision to start low-rate initial production would not be made without significant system-level testing, including both the carrier and the submunition. In addition, DOD stated that the criteria proposed by the Army for entering low-rate initial production would require the successful completion of multiple system tests with the ATACMS as the carrier. The response also stated that the planned testing for the submunition to support the low-rate initial production decision was consistent with and exceeded the original criteria established in the 1991 acquisition decision memorandum and that the criteria would have to be approved by DOD.

Nevertheless, the submunition's revised criteria, approved on October 4, 1995, do not require the Army to demonstrate that the ATACMS Block II can successfully dispense the submunition. We could not determine why such a demonstration is no longer required. The revised criteria call for the submunition to meet or exceed its performance specifications in its requirements document. Under these specifications, the Army will consider (1) how many kills are achieved per load of submunitions fired, (2) how well the system will operate in countermeasures, (3) how well the system will perform in degraded weather conditions, (4) how lethal the system is, and (5) how reliable the system operates. According to project office representatives, many of these requirements will initially have to be met using simulations but will eventually be verified through actual flight testing. However, the flight testing will not occur until after the low-rate initial production decision has been made. While the current criteria do not require that the submunition be dispensed from its carrier, officials from OSD, Army, and project office acknowledge that this is a key issue for the system's performance. Army and OSD representatives agree that they would like to see a demonstration of the carrier successfully dispensing the submunition before the submunition's production decision. However, this is not a requirement.

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## Submunition Development Is Behind Schedule

The brilliant antiarmor submunition's development is significantly behind its original and revised schedules. The submunition received approval to enter its engineering and manufacturing development phase on May 15, 1991. The plan at that time was for the Defense Acquisition Board to hold

its low-rate production decision review in November 1994. However, because of a change in the submunition's carrier and the technical difficulties being experienced with individual subcomponents, the Army approved a new program plan on September 22, 1995. This plan stretched out the development program by 3 years and rescheduled the low-rate initial production review for December 1997.

Despite the change in the program's plan, the submunition is still behind schedule. The submunition is currently behind its revised design verification test completion estimate by 6 months and behind its revised contractor development testing completion date by 8 months. Army officials maintain that the past slippage will have no impact on the scheduled December 1997 low-rate initial production decision, but admit that the schedule is extremely ambitious. Table 1 shows the September 1995 scheduled dates and the estimated slippage since the revised estimates.

**Table 1: Revised Submunition Program Schedule**

<b>Milestone events</b>	<b>September 1995 estimate</b>	<b>Current estimate</b>	<b>Slippage from September 1995 (months)</b>
Critical design review	5/92	5/92	Not applicable
Prototype production complete	Not applicable	9/95	Not applicable
Design verification test	10/95	4/96	6
Contractor development test	3/97	11/97	8
Low-rate initial production decision	12/97	12/97	

Source: Army program office data.

A significant portion of the submunition's test plan remains uncompleted. The project office has added five development flights to the test program because of technical problems, without extending the time to complete all the tests. Three of these flights were added by the contractor to verify hardware design changes that were made due to prior flight test failures. The other two flights were added as preproduction verification tests as a result of previously failed flight tests. The plan is to complete development flight testing and qualification testing in November 1997. According to the project manager, the entire test schedule is tight, and there is no time

available prior to the scheduled production decision to conduct additional tests should any new problems develop. For example, after a July 1997 developmental test failure, the project office continued with other planned tests without allowing time to analyze the failure or do a retest.

All of the submunition's flight testing will be done using a test aircraft with subsonic deployment rather than the supersonic deployment from its intended carrier, the ATACMS Block II missile. The Army has not included a flight test in its submunition's test plans to evaluate whether or not the carrier can dispense the final tactical submunition configuration.

However, the Army plans to conduct three ATACMS Block II flight tests to dispense the submunition within the next several months. During the first two tests, a nontactical version of the submunition will be used, but during the final test in December 1997, tactical submunitions will be used.

According to Army representatives, data from this test will not be used in making the submunition's low-rate initial production decision, since a test to dispense the submunition is not required. In addition, the ATACMS Block II missile tactical dispense tests are dependent upon the submunition's subcomponent qualification and development tests being completed by then. According to the former ATACMS Block II product manager, if any problems result from the submunition flight tests, the ATACMS Block II dispense tests would not be done until after the December 1997 low-rate initial production decision. The final Block II test might not occur until after January 1998.

The Army's ability to complete the remaining portion of the test schedule on time will be a significant challenge. The testing completed to date has uncovered numerous problems that have resulted in design changes, additional testing, and schedule delays. Some component failures have required repeated efforts to resolve. For example, the bands that secure the wings and tail fins to the submunition's body prior to it being dispensed from the missile have caused problems during two flight tests. When the submunition is dispensed, the bands are designed to fall away, allowing the wings and tail fins to deploy. During the first flight, however, the bands did not fall away from the submunition and prevented the wings from successfully deploying. Although the project office believed the problem had been solved, during a subsequent flight, the bands again failed to fall away, causing the submunition to crash. The second redesigned band system performed successfully in a May 1997 flight test. The entire process to redesign the bands required approximately 10 months to complete.



The three other components that have taken the longest time to qualify and have contributed to the bulk of the schedule delay are the inertial measurement unit, the deceleration and stabilization system, and the infrared seeker. Qualification testing was scheduled to be completed in November 1995. However, under the current schedule, qualification testing is not expected to be complete until November 1997.

The design and production of the inertial measurement unit, which provides in-flight data to adjust the submunition's flight path, continue to be significantly delayed. According to the product manager, the problems with the unit are the result of the change in carriers. As a result of this change, the unit had to be redesigned, and that effort has taken more than 2 years. As of the June 1997 performance report, the contractor had delivered 34 of 95 units and is at least 6 months behind schedule. The contractor problems with the design and production efforts have resulted in expensive plans to work around the problems and delays in integrating missile hardware. Although project office personnel told us that the technical problems had been resolved, the June 1997 production performance report stated that the inertial measurement unit program was falling further behind schedule. Because of the delays, the new unit is not expected to pass qualification testing until November 1997, after the completion of all submunition development flight tests. None of the currently planned development test flights will have a qualified inertial measurement unit. Thus, the primary objective of the developmental flight tests—to verify design and performance—will not be met.

The change in carriers also required the development of a deceleration and stabilization system. The brilliant antiarmor submunition was originally designed to be dispensed at the Tri-Service Standoff Attack Missile's subsonic speeds, but will now be dispensed at supersonic speeds by the ATACMS Block II missile. The deceleration and stabilization system is required to slow the submunition to subsonic speeds. The contractor has experienced technical problems with the design of the system that have caused additional schedule delays. In March 1997, the final design for the system was completed. As of the June 1997 report, the contractor had delivered only 25 of 96 units and is at least 2 months behind schedule. The May 1997 system qualification tests had to be suspended because two units failed during the tests. Project officials expect testing to resume in August 1997, a 3-month delay. Because of this delay, none of the submunition development tests will be conducted with a qualified deceleration and stabilization system.

The infrared seeker, which detects and guides the submunition to its target, is at least 8 months behind schedule. The contractor had delivered 49 of 99 units, according to the June 1997 performance report. During three test flights, the seeker experienced hardware failures that caused the submunition to crash. Two of the failures required the redesign and addition of new seeker components and caused testing delays. Because of the tight testing schedule, testing of the submunition will continue before a failure analysis is completed on the third failed flight. In addition, qualification testing revealed more problems that must be resolved before the seeker can be qualified. Qualification is not scheduled to be complete until November 1997. According to testing officials, the seeker will not be qualified until after the completion of all development tests.

## Submunition's Ambitious Schedule Is Unnecessary

The Army built in 8 months of excess time into the submunition's production delivery schedule, therefore it is unnecessary to make the low-rate initial production decision in December 1997. According to program officials, making the low-rate initial production decision in December 1997 is driven by the desire to have the submunition's delivery schedule coincide with the ATACMS Block II missile production schedule. However, a review of the program office production lead time and delivery requirements shows that the submunition's initial production contract can be awarded in August 1998 and still allow sufficient time for the submunition to be integrated into the missile. Delaying the decision would allow the Army additional time to complete its development test program.

The program office currently plans to award a limited production contract for 395 brilliant antiarmor submunitions in January 1998. However, 90 of these submunitions are funded with research and development funds and are considered developmental units. These units are required for the December 1999 ATACMS Block II operational test. The remaining 305 units are low-rate initial production submunitions, which are required to be delivered to the contractor, starting in April 2000, to be integrated into the first low-rate initial production Block II missiles. According to program officials, the lead time to produce the submunition is 18 to 19 months. However, under the current schedule, the 305 low-rate initial production submunitions do not need to begin delivery until 27 months after contract award. Our analysis of delivery requirements reveals that the contract award for the low-rate initial production quantities can be delayed 8 months, or until August 1998.

The Army's current brilliant antiarmor submunition schedule is linked to the ATACMS Block II December 1999 operational test date and July 2000 first missile delivery date. To meet these dates, the contract for low-rate initial production of the ATACMS Block II missiles must be awarded in January 1999. However, the ATACMS Block IA missile's planned full-rate production decision was recently delayed by 1 year, to March 1998, because of a "sensor to shooter" problem that surfaced during initial operational testing. The Block IA's problems may not be resolved before the Block II is ready to enter production. According to representatives from the Office of the Director, Operational Test and Evaluation, and the Army Operational Test and Evaluation Command, the "sensor to shooter" problem will also affect the Block II missile. If the Block II missile's schedule is delayed at all, the submunition's initial production contract could be delayed even further, allowing more time to complete submunition testing.

Neither the ATACMS nor the brilliant antiarmor submunition has a sensor that can provide necessary targeting information and must rely on targeting data supplied from external sources. The submunition must have initial targeting information prior to launch and missile positioning information while in flight. For example, a moving column of armored vehicles' initial location must be identified prior to launching the missile. According to project office officials, this target information must be as precise as possible.

The Army recognizes that the lack of a targeting sensor is a serious problem. A general officer steering committee has been established to further investigate the problem and to recommend a solution. According to testing officials, the ATACMS Block II's and brilliant antiarmor submunition's operational performance must be evaluated using targeting information. They indicated that without a solution to the "sensor to shooter" problem, the effectiveness of the system would be affected, and missile production delays would be warranted.

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## Recommendation

Given the criticality of the dispense to the brilliant antiarmor submunition program, we recommend that the Secretary of the Army require the program office to demonstrate that qualified tactical submunitions can be successfully dispensed from the ATACMS Block II missile before seeking a low-rate initial production decision on the submunition program. According to production requirements, the submunition can still meet its existing delivery schedule with the ATACMS Block II missile, even with an

8-month delay in awarding the low-rate initial production contract. Such a delay would allow more time for the Army to resolve the submunition's technical difficulties and demonstrate that it can be successfully dispensed from the ATACMS Block II missile.

## Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD indicated that it did not believe that it was necessary to perform a "full-up" dispense test of tactical submunitions from the ATACMS Block II missile prior to the low-rate production decision. DOD stated that even though successful dispensing of tactical submunitions was not a formal criterion to be met before the decision to go into production, two Block II missile tests are scheduled to dispense a tactical submunition before the production decision and that information from these tests would be used in its assessment of the submunition. DOD also stated that delaying the submunition's low-rate initial production by 8 months would delay the Block II missile's initial operational and live fire testing by 8 months and subsequently delay the Block II's full-rate production decision, as well as significantly increase costs.

We are not persuaded by DOD's argument for the following reasons and have retained our recommendation. First, OSD and Army officials told us that the dispense event was a key performance objective for the project because of its criticality to the system's effectiveness. Second, a successful dispense event was a requirement for the low-rate production decision before the change in carriers. Third, problems are currently being experienced in the submunition's development testing and delays are already occurring. Finally, if the Army is not confident that the submunition can meet this standard, it should not seek approval for low-rate production.

The Army does not need to start low-rate production to obtain additional submunitions to complete development activities and for testing. If additional submunitions are procured using separate contracts—a January 1998 research and development contract to procure assets for the operational and live fire testing and a subsequent procurement contract for low-rate production when the submunition demonstrates its performance—the Block II's schedule would not necessarily be delayed. Even if the schedule would be delayed, we believe DOD should be more concerned about the risks associated with starting the production of an unqualified and largely unproven system.

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DOD's comments are presented in their entirety in appendix I, along with our evaluation of them.

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## Scope and Methodology

To determine whether the brilliant antiarmor submunition acquisition plan was on schedule, we reviewed current Army submunition and ATACMS Block II missile program testing and production schedule documentation with officials in the ATACMS-BAT project office, Redstone Arsenal, Alabama. We also reviewed similar documentation with officials in the Offices of the Assistant Secretary of the Army for Research, Development, and Acquisition and the Deputy Chief of Staff of the Army for Operations and Plans, Washington, D.C.

To determine whether the brilliant antiarmor submunition has successfully demonstrated its technical readiness to enter production, we reviewed current and prior criteria to evaluate the requirements to be demonstrated before entering production. We then evaluated test plans, test results, and contractor performance reports with ATACMS-BAT project office officials, Redstone Arsenal, Alabama, to determine whether the submunition had demonstrated all the required events. We also discussed testing and criteria issues with representatives from the Office of the Director, Operational Test and Evaluation, Washington, D.C.; the Army's Operational Evaluation Command, Alexandria, Virginia; and the Assistant Secretary of the Army for Research, Development, and Acquisition, Washington, D.C.

We conducted our review from April to August 1997 in accordance with generally accepted government auditing standards.

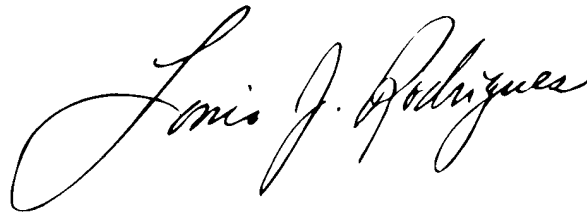
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As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to other interested congressional committees; the Secretaries of Defense and the Army; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others upon request.

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If you or your staff have questions concerning this report, please contact me at (202) 512-4841. The major contributors to this report were Bill Graveline, Laura Durland, and John Randall.

Sincerely yours,

A handwritten signature in cursive script that reads "Louis J. Rodrigues". The signature is fluid and elegant, with a large initial "L" and a distinct "J" and "R".

Louis J. Rodrigues  
Director, Defense Acquisitions Issues

# Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



ACQUISITION AND  
TECHNOLOGY

## OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3000

12 SEP 1997

Mr. Louis J. Rodrigues  
Director, Defense Acquisitions Issues  
National Security and International Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "BRILLIANT ANTI-ARMOR SUBMUNITION: Opportunity Exists to Conduct Critical Test Prior to Production Decision," dated August 1997 (GAO Code 707243/OSD Case 1430). The Department of Defense non-concurs with the recommendation that the criticality of the dispensing of BAT submunitions from the ATACMS Block II missile necessitates full-up tactical dispensing of BAT submunitions from the Block II missile prior to the BAT LRIP decision.

The BAT submunition and the ATACMS Block II missile are both components of the ATACMS/BAT Major Defense Acquisition Program and are managed by a single project office and developed under different contracts. BAT and Block II testing is integrated in a single Test and Evaluation Master Plan. The demonstration of successful tactical dispensing of BAT submunitions from the Block II missile is part of the Block II missile developmental testing. At least two Block II test flights have always been scheduled prior to the BAT LRIP decision. Even though successful dispensing of BAT is not a formal exit criterion for the BAT LRIP decision, such testing has always been planned and the results will be considered in that decision.

GAO findings, apart from the overall recommendation, are addressed in detail in the attachment to this letter. The Department appreciates the opportunity to review the draft report.

Sincerely,

George Schneider  
Director  
Strategic and Tactical Systems

Attachment:  
As stated



GAO DRAFT REPORT - DATED AUGUST 6, 1997  
OSD CASE 1430, GAO CODE 707243

"BRILLIANT ANTI-ARMOR SUBMUNITION: OPPORTUNITY EXISTS TO  
CONDUCT CRITICAL TEST PRIOR TO PRODUCTION DECISION"

DEPARTMENT OF DEFENSE COMMENTS ON THE GAO  
FINDINGS AND RECOMMENDATION

**FINDING A: Key Performance Criteria Relaxed.** The Army is not required to demonstrate that BAT can be successfully dispensed from ATACMS Block II prior to the LRIP decision. While this was an original BAT EMD exit criterion, when the criteria were revised after the termination of the Tri-Service Standoff Attack Missile, OSD and the Army deleted the requirement.

**DOD RESPONSE:** Partially concur. The OSD-approved exit criteria do not require BAT to be dispensed from the ATACMS Block II prior to a BAT LRIP decision. However, the Army's test plans do include an evaluation of whether or not ATACMS Block II can dispense the submunition.

BATs were used in Block II static testing of skin separation and submunition dispensing. To verify BAT aerodynamic performance, a full scale, supersonic Block II sled test successfully dispensed BAT simulants with high speed stabilizers. Many hours of wind tunnel data have been collected to verify Block II/BAT flowfield effects. The BAT is being qualified to operate in an ATACMS Block II dispense environment. The first Block II flight test, currently scheduled for September 15, 1997, will demonstrate the ability to safely dispense BAT from the ATACMS Block II, using BAT simulants equipped with various data-collecting instrumentation. Additionally, two Block II Pre-Production Tests (PPT) are currently scheduled prior to the December 1997 BAT LRIP decision point. These PPT flights will each include a tactical BAT, in addition to instrumented BAT simulants.

The program has always had at least two Block II test flights scheduled to occur prior to the BAT LRIP decision. Even though demonstrating dispensing is not a formal exit criterion, it has always been planned for and will be considered in the LRIP decision.

**FINDING B: Submunition Development Is Behind Schedule.** Testing to date has required BAT design changes. The compressed testing schedule does not allow for adequate analysis and further changes. The project office has added five development flights to the test program because of technical problems, without extending the time to complete all the tests. Because of the tight testing schedule, testing of the submunition continued before a failure analysis was completed on the third failed flight. In addition, qualification testing revealed more seeker problems that must be resolved before the seeker can be qualified. As a result, none of the submunition developmental flights will have a qualified seeker available for testing.



Appendix I  
Comments From the Department of Defense

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**DOD RESPONSE:** Partially concur. It is a normal aspect of a test program to optimize design. The current testing schedule is aggressive, but adequate time is available for analysis and design changes barring major test problems. The Army has adamantly maintained a test/fix/test approach to all of the Contractor Development Test (CDT) flights and always ensured that the necessary analysis was completed before conducting the next test flight in the series. The original plan allocated 21 BAT test vehicles to the CDT program, 16 for flight tests and 5 for spares to be used in the event technical problems were encountered. The test units to be used in the additional CDT testing and the pre-production verification test (PPVT) flights are part of the original 21 vehicles. These tests were added to gain confidence prior to the LRIP contract award. Also, as mentioned in the report, the time to complete the flight tests has been extended from the original plan.

See comment 1.

A failure investigation of the third CDT flight, mentioned in the report, was initiated and a fault tree was established. Before executing the next flight test, all nodes of the fault tree were closed with the exception of two. One of those nodes was open waiting for a test to be completed. All evidence from data previously gathered indicated that this node had an extremely low probability of being identified as the root cause of the failure. The other open node, and most likely cause (consequently confirmed as the root cause) of the flight failure, was a component process problem that was confined to a single lot. All hardware from this lot was removed from the seekers and replaced with good hardware; the entire bad lot was rejected. The seeker in the next flight vehicle did not contain hardware from this bad lot, so the risk was determined to be low to proceed with the flight test. The next test flight occurred, and this component performed successfully.

See comment 2.

The planned seeker qualification tests have been completed, and the seeker did experience some anomalies that will require additional testing prior to approval of the qualification report. No hardware change is anticipated due to these anomalies. The final CDT (CDT-11) and the PPVT flight vehicles will be flown with the final EMD tactical configuration of the IR Seeker. This final EMD tactical configuration incorporates a new heated dome and a redesigned gas bottle. These changes are scheduled to be qualified prior to CDT-11.

**FINDING C: Submunition's Ambitious Schedule Is Unnecessary.** LRIP can be delayed by 8 months without substantial problems with the Block II schedule. The ATACMS Block IA "sensor-to-shooter" problem may delay Block II production.

See comment 3.

**DOD RESPONSE:** Nonconcur. The planned LRIP contract, in addition to procuring 305 submunitions with procurement funds, procures 90 submunitions with RDT&E funds. The 90 submunitions used in Live Fire Test and Evaluation (LFT&E) and Initial Operational Test and Evaluation (IOT&E) will be produced on the BAT LRIP line. Given the minimum projected 19- to 20-month lead time, the LRIP contract must be awarded by the end of January 1998 to meet Block II missile integration timelines associated with IOT&E flight tests. Failure to procure these 90 submunitions under the LRIP contract would require a separate contractual instrument to meet IOT&E requirements and would significantly increase costs, due to buying a smaller quantity with the resulting spread of facilitization, tooling, and other non-recurring costs over 90 units instead of 395 units. The GAO's position does not take into account the realities of proper

Appendix I  
Comments From the Department of Defense

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production planning, the need to ramp up to needed production levels, and smooth manpower loading of production lines. As the BAT will be provided as GFE to the Block II integration contractor, sufficient schedule risk mitigation must be included to prevent missile production line stoppages. Delaying LRIP by 8 months would delay IOT&E and LFT&E at least 8 months and, subsequently, delay the Block II full-rate production decision and fielding. Cost impacts associated with delaying LRIP include increasing the cost of the 90 RDT&E units by at least \$25M and increasing RDT&E by \$12.3M over 3 years to support first article testing, production verification testing, and general oversight. The delay also would delay award of the FY99 Block II contract, creating a 5-6 month gap in the Block II warhead and BAT manufacturing lines and causing potential re-qualification of some subsystems and increasing unit costs; and would increase production costs of the Block IA missile by \$10-12M due to loss of concurrent production with the Block II.

The report mentions a "sensor-to-shooter" issue with Block IA also affecting the Block II missile. The Block IA targeting issue refers to engagements out to the missile's maximum range and the requirement for small target location errors prior to launch. The Block II missile engages targets at ranges half that of Block IA. Also, the Block II does not require the delivery accuracy of the Block IA due to the large acquisition footprint of the BAT submunition. The key "sensor-to-shooter" issue for the Block II will be the demonstrated ability to acquire and process timely and accurate targeting information on moving targets. The Block II missile's ability to effectively engage moving targets will be properly demonstrated prior to the missile's entering full-rate production.

The report implies that the ATACMS Block II/BAT system will not be successful unless it has a targeting sensor on the missile and that the missile must receive updated targeting information in-flight. This is incorrect. The Block IA and Block II do receive updated positioning information in-flight; however, they do not receive, and do not require, updated targeting information. Prior to launch, when the Block II missile receives targeting information, a prediction is made as to target location, based on target column speed, and where the target column will be at the time when the missile will arrive at a chosen dispense point. Because of the BAT's large acoustic footprint, it can overcome large target-location ambiguities from this targeting process and still effectively engage the target.

**RECOMMENDATION:** Given the criticality of the dispensing to the brilliant anti-armor submunition program, the GAO recommended that the Secretary of the Army require the program office to demonstrate that qualified tactical submunitions can be successfully dispensed from the Army Tactical Missile System Block II missile before seeking a low-rate initial production decision on the brilliant anti-armor submunition program. (pp. 13-14/GAO Draft Report)

**DOD RESPONSE:** Non-concur. The Army's test plans include an evaluation of whether or not ATACMS Block II can dispense the submunition as part of the Block II missile testing. A successful dispense is not a formal exit criterion for the BAT LRIP decision, although two Block II PPT tests are currently scheduled prior to the December 1997 BAT LRIP decision point, each including a tactical BAT. The Army and OSD test communities will utilize all available BAT and Block II test data to assess BAT's readiness to enter production.

See comment 4.

See comment 5.

See comment 6.

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The following are GAO's comments on the Department of Defense's (DOD) letter dated September 12, 1997.

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## GAO Comments

1. Although DOD states that the Army has adamantly maintained a test/fix/test approach to all test flights and always ensured that the necessary analysis was completed before conducting the next test flight in the series, DOD acknowledges that the Army had not completed the root cause analysis on the third seeker flight failure before executing the next flight test.
2. After the draft of this report was sent to DOD for comment, the Army revised its testing schedule to postpone the final flight tests from October to November 1997. If the seeker testing had progressed as planned, the Army should have been able to use a qualified seeker in this final test. However, program officials have subsequently confirmed that the seeker test schedule has since slipped even further behind because of technical difficulties. The program office has had to add additional modifications and testing to the seeker. Program officials state they will not be able to qualify the seeker prior to the completion of the development flight tests, even with the date slip reflected in DOD's comments.
3. If the Army needs more submunitions to complete development activities and for testing, it is not necessary to start low-rate initial production to do that. For operational testing purposes, the standard is that the submunitions be production representative, not production missiles. Because of the difficulty in stopping production once it starts, we are concerned about the Army starting production of an unqualified and largely unproven submunition. We are also concerned about the use of acquisition strategies that tend to force the start of low-rate production on a definite schedule, regardless of the status of the development effort. Moreover, in our opinion, the potential costs associated with buying a submunition that has significant unresolved technical problems more than offsets concerns about potential costs that may be incurred if production was delayed until the technical problems are resolved.
4. According to DOD testing officials, the Army has not demonstrated that it has a dedicated sensor that can provide accurate targeting information to the Block IA missiles. These officials maintain that this is an issue for the Block II missile. To indicate how serious this issue is, DOD has established a general officer steering committee to resolve the problem. The Block II's schedule may still be delayed because of this problem.

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Appendix I  
Comments From the Department of Defense

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5. We have modified the report to address this comment.

6. While the Army wants only to consider the results from tests that may occur prior to the production decision, we believe the Army must demonstrate that it can successfully dispense qualified tactical brilliant antiarmor submunitions before seeking approval for low-rate initial production.

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